Occupational Risks of Bladder Cancer in the United States: II. Nonwhite Men

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Occupational risks of bladder cancer among nonwhite men were assessed based on interviews with 126 cases and 383 controls conducted during the National Bladder Cancer Study, a population-based, case-control study conducted in 10 areas of the United States. Our findings indicated that nonwhite men who were ever employed as auto workers have an elevated risk of bladder cancer [relative risk (RR) = 2.3; 95% confidence intervals (CI) = 0.8-6.4] with a significant positive trend in RR with increasing duration of employment ($P = .017$) and with the RR rising to 4.7 for those employed at least 10 years. Dry cleaners, ironers, and pressers also experienced increased bladder cancer risk (RR = 2.8, CI = 1.1-7.4). Nonsignificant excesses of similar magnitude to those seen among white men were found for nonwhite men employed in several other occupations. Overall, our findings suggest that the risk of occupational bladder cancer among white and nonwhite men is similar. When inconsistencies between whites and nonwhites did occur, they appeared either due to chance or possibly racial differences in exposure among men within the same industry and occupation. In all, we estimate that the population attributable risk for occupation among nonwhite U.S. men is 27% (CI = 9% to 56%), which is slightly higher than the estimate of 21% to 25% previously reported for white U.S. men, although this difference was not statistically significant. [J Natl Cancer Inst 81:1480-1483, 1989]

In this study, we examined the relation between occupation and bladder cancer risk among nonwhite men in the United States. Few previous studies have included nonwhites, and only one study has had adequate numbers to allow investigators to examine occupational risks among nonwhite men separately (*1*).

Our data on occupation and bladder cancer risk among nonwhite men were collected as part of the National Bladder Cancer Study, which was a large, population-based, case-control study conducted in 10 geographic areas of the United States. We undertook this investigation to identify high-risk occupations for bladder cancer among nonwhite men and to compare these findings with those previously observed among white men in our study (*2*).

Materials and Methods

For the purpose of this occupational analysis among nonwhite men, the study group included 126 cases and 383 controls. Of the nonwhite men, 70% of the cases and 75% of the controls were black. A detailed description of the study methods can be found in Silverman et al. (*2*).

Results

In table 1, cases and controls are compared with respect to a number of descriptive variables pertaining to occupational history. Controls were similar to cases with regard to most factors, except age at initial employment, which was slightly younger for cases compared with controls.

A Priori Suspect Occupations

Table 2 shows relative risks (RRs) for workers in all a priori suspect occupations. Those occupations with summary categories are presented first, with subcategories for which workers had RRs of at least 1.3 or 0.6 or less. These are followed by some miscellaneous specific occupations that did not fit easily into a summary category.

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Table 1. Comparison of cases and controls by employment patterns, nonwhite males

Occupation factor	Mean values	
	Cases	Controls
No. of years employed	40.9	40.7
Age at first employment	16.9	18.3
No. of industries	4.7	4.6
No. of occupations	5.1	5.1
No. of jobs	7.1	6.9
No. of subjects	126	383

Of the a priori suspect occupations, the only statistically significant, increased risk was observed for dry cleaners, ironers, and pressers (RR = 2.8, CI = 1.1-7.4). Nonsignificant elevations in risk (i.e., RR $\geq$ 1.3) were apparent for the following 12 a priori suspect occupation categories:

- Painter, construction and maintenance
- Taxicab driver and chauffeur
- Auto mechanic
- Cook and food service worker in retail eating and drinking places
- Construction processing worker
- Petroleum processing worker
- Carpenter
- Auto worker
- Garage worker and gas pump attendant in gasoline service stations
- Stationary fireman or furnace operator
- Clerical worker
- Policeman, detective, and guard

Table 2. No. of cases and controls ever employed in each occupation category and RRs, nonwhite males

Occupation title	Cases*	Controls*	RR†	95% CI
Summary categories and a priori suspect occupations				
Summary leather worker	4	19	0.9	0.2-3.0
Summary painter	5	16	1.2	0.4-3.7
Painter, construction and maintenance	4	10	1.4	0.4-5.4
Summary driver of motor vehicles	40	118	1.0	0.6-1.5
Taxicab driver, chauffeur	10	19	1.3‡	0.5-3.2
Summary mechanic	13	32	1.1‡	0.5-2.5
Auto mechanic	6	15	1.4§	0.4-4.4
Summary metal machinery worker	26	71	1.1	0.6-1.9
Summary ore refining and foundry worker	5	26	0.5	0.2-1.4
Furnaceman, smelterman, pourer	3	14	0.6	0.1-2.2
Molder, metal	2	14	0.4	0.1-1.7
Summary welder, flamecutter, solderer	4	15	0.9	0.2-3.0
Summary metal working and fabrication occupation	13	39	1.0	0.5-2.0
Summary construction worker, stonecutter, stone carver	22	74	1.0‡	0.5-1.8
Construction processing worker	8	17	1.5	0.5-3.8
Summary petroleum worker	4	6	2.1	0.5-9.2
Summary salesman and sales manager	7	21	0.8‡	0.3-2.2
Summary lumberman and woodworker	8	32	0.7	0.3-1.6
Carpenter	7	13	1.3	0.4-3.6
Summary cook, baker, food counter worker	18	41	1.2¶	0.6-2.4
Cook in retail eating and drinking places	6	12	1.6	0.5-5.1
Summary food service worker	17	50	1.1	0.6-2.2
Food service worker in retail eating and drinking places	5	11	1.5	0.4-4.9
Summary actor, artist, musician, writer	5	14	1.1‡	0.3-3.6
Miscellaneous a priori suspect occupations				
Auto worker	10	18	2.3	0.8-6.4
Garage worker and gas pump attendant in gasoline service stations	6	11	1.6	0.5-4.9
Stationary fireman or furnace operator	5	10	1.4‡	0.4-5.1
Chemical processing worker	4	12	0.8	0.2-2.8
Dry cleaner, ironer, presser	11	12	2.8‡	1.1-7.4
Health administrator, nurse, chiropractor	3	17	0.6	0.1-2.3
Clerical worker	18	33	1.6‡	0.8-3.2
Policeman, detective, guard	13	25	1.5	0.7-3.2
A posteriori low-risk occupations**				
Forklift and tow motor operative	1	17	0.1	<0.1-0.9
Craneman, derrickman, hoistman	3	23	0.4	0.1-1.4
Checker, examiner, inspector, manufacturing, NEC	1	18	0.2	<0.1-1.2
Manufacturing, laborer, NEC	16	74	0.6	0.3-1.1
Private household worker	4	21	0.6	0.2-2.1
Postman, ticket agent	4	24	0.5	0.1-1.5
Teacher, economist, mathématician, psychologist, social scientist, NEC	4	22	0.6	0.2-1.9
Lawyer, judge, administrator, NEC	2	15	0.4	0.1-2.0

*Values indicate No. of males who were ever employed in each occupation.

†Risk is given for workers in each occupation, relative to a risk of 1.0 for males never employed in that occupation. Smoking-adjusted RRs are given in every instance, unless otherwise specified.

‡Adjustment was made for smoking and employment in other high-risk occupations.

§Adjustment was made for smoking and age.

¶Adjustment was made for smoking and education.

**_See_ Materials and Methods section for definition. NEC = not elsewhere classified.

Nonsignificant decreased risks (i.e., RR $\leq$ 0.6) were observed for workers in the following a priori suspect occupations: furnaceman, smelterman and pourer; metal molder; and health administrator, nurse, and chiropractor.

A Posteriori Low-Risk Occupations

There were no new high-risk occupations for nonwhite men (i.e., statistically significant increased RRs and/or RRs $\geq$ 1.5). Occupations not previously suggested as being high risk, in which workers had a decreased risk that was either statistically significant, or 0.6 or less in magnitude, are also presented in table 2. Decreased risks were observed for workers in eight occupational categories: forklift and tow motor operative; craneman, derrickman, and hoistman; checker, examiner, inspector in manufacturing; laborer in manufacturing; private household worker; postman and ticket agent; teacher, economist, mathematician, psychologist and social scientist; and lawyer, judge, and administrator. Of these, only the decreased risk among forklift and tow motor operatives was statistically significant.

Temporal Factors

The relationship between duration of employment and bladder cancer risk for workers in all occupation categories with an overall RR of at least 1.0 was assessed. Workers in only three occupations experienced a statistically significant trend in risk with increasing duration: auto worker; dry cleaner, ironer, and presser; and clerical worker (table 3). Auto workers experienced a consistent and significant positive trend in risk with increasing duration of employment. The RR for auto workers employed 10 or more years was 4.7. Although the trend in risk with increasing duration of employment as a dry cleaner, ironer, and presser was significant, it was inconsistent. In fact, risk was highest for those employed less than 5 years (RR = 5.3). Clerical workers also experienced increased risk with increasing duration of employment; those employed for at least 10 years had an RR of 2.9.

Population Attributable Risks

We estimated the population attributable risk (PAR) for occupation using various definitions of occupational risk. The estimate we selected for presentation was achieved when we defined occupational risk as employment either in an a priori suspect occupation with an RR of at least 1.1, or in any occupation with an RR of at least 1.5, or with a significant duration effect. Workers in a priori suspect occupations with an RR of less than 1.1 were excluded because such exposure did not explain any excess risk in our data. The PAR estimates based on this definition of occupational risk are identical to those based on occupational risk defined as simply employment in an a priori suspect occupation with an RR of at least 1.1, because there were no newly identified high-risk occupations among nonwhite men in this study.

Our overall estimate of the PAR for occupation in nonwhite men was 27% (CI = 9% to 56%). This estimate varied with age at diagnosis; it was higher for those under age 65 years (PAR = 37%, CI = 11% to 74%) than for those aged 65-84 years (PAR = 20%, CI = −14% to 53%). When the study group was restricted to black men, the PAR estimate was virtually identical to the estimate for the total group of nonwhite men (PAR = 26%, CI = 6% to 66%).

Discussion

The strongest evidence of increased risk of bladder cancer among nonwhite men in these data is that for auto workers. The overall RR for auto workers was 2.3, but it was not statistically significant. A significant and consistent positive trend in risk with increasing duration of employment as an auto worker was apparent, however. The RR for those employed 10 or more years was 4.7.

Auto worker was first suggested as a potential high-risk occupation for bladder cancer in a descriptive study that indicated that elevated bladder cancer mortality among white men in various high-risk counties from 1950 to 1969 might be due to occupational exposures within the motor vehicle manufacturing industry (*3*). Findings from four subsequent studies, however, provided essentially no support for a positive association between employment as an auto worker and bladder cancer risk among white men (*4-7*). In fact, findings from the Detroit component of our study indicated that white male auto workers had little or no excess risk of bladder cancer (*8*). The discrepancy between the races in the current

Table 3. No. of cases and controls and RRs, according to duration of employment in specified occupation, nonwhite males*

Occupation title	Duration (yr)	Cases	Controls	RR†	Trend test (*P*)
Auto worker‡	<4	2	7	1.2	.017
	5-9	2	6	1.6	
	10+	6	5	4.7	
Dry cleaner, ironer, presser	<5	7	5	5.3	.016
	5+	4	7	1.8	
Clerical worker	<5	7	13	1.6	.018
	5-9	4	10	1.4	
	10+	7	9	2.9	

*Males with unknown duration of employment were excluded.

†Risk is given for workers in each level of duration of employment in the specified occupation, relative to a risk of 1.0 for males never employed in that occupation; adjustment was made for smoking and age.

‡Data are restricted to Detroit auto workers because all nonwhite male auto workers in the study resided there.

study is explained by differential levels of job skill between white and nonwhite male auto workers. Of the male auto workers, 43% of the nonwhites were unskilled laborers, compared with 9% of the whites. By restricting the auto worker category to laborers only, we found that such white males did experience increased bladder cancer risk similar to that among nonwhites in this category (RR = 2.1, CI = 0.6-7.3). Previous studies appear to have had inadequate numbers of exposed subjects for investigators to estimate risk separately for unskilled laborers within the automobile industry.

The excess bladder cancer mortality among white men from 1950 to 1969 in high-risk counties may have been the result of exposures in the auto industry at a time when a substantial proportion of white auto workers may have been unskilled laborers. Perhaps, as whites moved out of this occupation category over the past three decades and nonwhites moved in, the excess risk became difficult to detect among the white auto workers as a group and more apparent among the nonwhite men.

Because employment as an unskilled laborer in the auto industry is not associated with any specific exposure, and because this is the first analytic report of an excess bladder cancer risk among auto workers, substantial confirmation will be required before interpretation regarding causality can be made.

We observed a significant increased risk among nonwhite men for only one a priori suspect occupation: dry cleaner, ironer, and presser. Although a significant positive trend with increasing duration of employment as a dry cleaner was apparent, it was not consistent. The RR for those employed less than 5 years was 5.3, whereas those employed 5 years or more had an RR of 1.8. Although this finding does not support a causal interpretation of the overall result, it may be that short-term dry cleaners have higher exposures to potential carcinogens in the workplace than do some long-term dry cleaners.

Of five previous reports regarding dry cleaners, four were positive (*9-12*) and one was negative (*13*). Results of an earlier report from our study (*14*) indicated that white male dry cleaners experienced no excess bladder cancer risk. The discrepant results for whites and nonwhites in our data could be due to chance or to racial differences in exposure among men in the same occupation. Dry cleaners are exposed to many potential carcinogens, including perchloroethylene and petroleum solvents (*11*), which adds support to the evidence that this excess may be real and should be pursued.

Nonwhite male clerical workers also experienced increased bladder cancer risk, with a significant positive trend with increasing duration of employment. This excess, however, was not apparent among white men in our study (*2*). Although an increased bladder cancer risk among clerical workers has been reported in two studies (*15,16*), no credible biologic explanation for this elevation has been suggested.

Many of our other findings for nonwhite men are consistent with those previously observed for white men (*2*). Increased risks were apparent for both nonwhites and whites employed in the following occupations: painter, construction and maintenance; taxicab driver and chauffeur; petroleum worker; carpenter; and stationary fireman or furnace operator.

Our overall estimate of the PAR for occupation among nonwhite men was 27%. This estimate was based on our defining occupational risk as employment in either an a priori suspect occupation with an RR of at least 1.1 or any occupation with an RR of at least 1.5 or with a significant duration effect. Our PAR estimate for occupation among nonwhite men is slightly higher than the similarly derived estimate of 21% to 25% previously reported for white men in this study (*2*). This difference, however, was not statistically significant.

Overall, our findings suggest that occupational bladder cancer among white and nonwhite men is similar. When inconsistencies between whites and nonwhites did occur, they appeared either due to chance or possibly racial differences in exposure among men within the same industry and occupation.

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